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- b. To restore the lost information of Japanese geologists' work and to present ☐ new findings on that subject, and
  - c. To give a general clue to the metallogenetic provinces of rare metals deposits and predict the probable and possible areas bearing future prospects. The reserve of the newly discovered deposits has not yet been fully ascertained, but it is believed that considerable quantities must have already been found or will be found in the near future on account of the current cooperative activities undertaken in China.
3. According to the geological occurrence and geographical distribution four areas have been subdivided, namely: North Manchuria, South Manchuria, Suiyuan, and the Nanling Range. In addition several localities bearing possibilities have also been included, although their possible occurrence may require future investigation and confirmation.
  4. The genesis of the rare metals deposits may be classified into three types:
    - a. Placer deposits as those occur in the gold placer provinces of North Manchuria, the beach sands of Liaotung Peninsula, and the tin placer province of Kwangsi,
    - b. Pegmatitic deposits of South Manchuria and Suiyuan provinces, and
    - c. Hydrothermal deposits of the Nanling Range. Among them pegmatitic veins are the most widespread type and thus deserve special attention.
  5. Most pegmatite-veins are banded or zoned and generally have ores concentrated as units. The distribution of metallic minerals in pegmatite-veins has no uniformity and thus the grade and size of the deposits are unpredictable. Most of the known pegmatites in China do not contain sufficient quantity of uranium-minerals to warrant mining for uranium alone, but considerable quantities may be recovered as by-products of mining for other non-radioactive rare metals.
  6. The western coast of Liaotung Peninsula has one of the richest pegmatite-type deposits in the world, from which large quantities of radioactive and non-radioactive minerals may be mined at profit. There are four main lithological types of pegmatites containing abundant rare-metal minerals. Their mineral associations have been summarized in the following table.

Mineral Association	ROCK TYPES			
	Ordinary Pegmatite	Biotite-albite Pegmatite	Muscovite-albite Pegmatite	Lepidolite-K-feldspar Pegmatite
Monazite	*			
Allanite	**	*		
Zircon	*	(*)		
Betafite	*	**		
Samarakite	*	**		
Euxenite		**	(*)	
Fergusonite		**	*	
Beryl			**	*
Columbite			**	*
Lepidolite				**
Muscovite	(*)		**	
Biotite	(*)	*		
Tourmaline	* (black)	(*)	(*)	** (green)
Garnet			*	*
Topas				**
Fluorite				**
Characteristic Rare Metals	U, Th, Zr, Ce.		Be, Ta, Nb, Li.	

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THE PLACER DEPOSITS OF NORTH MANCHURIA

7. The gold-placers of North Manchuria provinces commonly contain considerable amounts of minerals of rare metals, such as monasite, zircon, tantalite, columbite, etc, mixed with black sands consisting of cassiterite, magnetite, ilmenite, garnet, etc, as the residual detrital minerals disintegrated from Pre-Cambrian gneisses and granites.
8. The placers occurring in Hepei, Yilang district of Hokiang province (合江俄市黑背) contain 6-7.3% zircon, 14-15% monasite as well as a small amount of tantalite, columbite and cassiterite etc. Those occurring in the Muling district of Sungkiang province (松江省穆陵县?) contain 8% zircon and 4.1% monasite. In Chungtangkou, Mohar, Heilungkiang province (黑龙江漠河中段) the placers contain 0.7-8.3% zircon, 4.5-5.3% monasite, and a small amount of Ni-Ta-minerals.
9. The extensive distribution of placer deposits in the stream valleys in North Manchuria forms a possible main source of rare metals. Monasite sands can definitely be extracted as by-products of gold mining. It is estimated that the productivity of monasite from gold placers may be taken as 50 to 100 times of the amount of gold produced.

PEGMATITIC DEPOSITS OF LIAOTUNG PENINSULA

10. The main rare metals resources of China occur chiefly in the South Manchuria peninsula provinces of Liaoning and Antung as pegmatite minerals in the pegmatites veins intruded into pre-Cambrian gneissic granites. Such rare metals bearing pegmatite veins are restricted to the igneous and metamorphic complex of the Sino-Korean Massif, probably of pre-Cambrian age. In this area three belts of distribution along the general trend of the peninsula in a north-south direction have been recognized namely, the west coast of the Gulf of Liaotung, the west coast of Liaotung Peninsula, and the east coast of that Peninsula. Among the ore minerals occurring in pegmatites, those containing uranium, thorium, zirconium, cerium, and other heavy rare elements are most abundant.
11. A. The West Coast of the Gulf of Liaotung  
Both granite-pegmatite veins and secondary placer deposits were found along the west coast of the Gulf of Liaotung in several districts such as Chingchow, Chingsi, and Suichung (锦州锦西绥中). Euxenite, zircon, and allanite have been found in pegmatites at Tienchiac village of Chingchow (锦州林常村), and zircon and monasite in placer deposits nearby. In Tashan village of Chingsi (锦西塔山村) zircon and monasite have been found in placers, but only zircon in pegmatite veins. In Suichung district the pegmatite veins of Kaotai village (高台村) contain euxenite, zircon, and allanite; those of Chingze village (金线村) contain betafite, zircon, and allanite; and in the placer deposits of the latter locality zircon and monazite have also been found. The economic importance of the rare metals deposits in this area has not been ascertained yet.
12. B. The West Coast of Liaotung Peninsula  
The west coast of the peninsula, comprising districts of Liaoyang, Haicheng, Kaiping, and Shyongyao (沈阳海城开平远安) forms the main reserve of rare metals and the most productive belt in China. The occurrence of the minerals in pegmatite veins are of two types. The biotite-pegmatite veins bear euxenite and betafite with minor amounts of fergusonite, thoregumite, samarskite, zircon, allanite, etc, whereas in muscovite-pegmatite veins tantalite, columbite, beryl, monasite, etc, are predominant.

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24. The pegmatite veins in Huanghwaestung (黄花格小同), Tsungshenkou (潼关), Hsuehshenkou (徐馬溝) of Taoling district (陶林) have long been known to produce amethyst beryl, and topaz. North of Kuyang (周陽) natives worked out two thousand kilos of rock-crystal and a large quantity of muscovite from pegmatite veins.
25. In Langyuan (浪源), Wutai (五台), and Hungyuan (渾源) of northern Shensi beryl crystals have been found in some pegmatite veins. On account of the extensive distribution of Archaean granites and gneisses and intruded pegmatite veins, some rare metals deposits might possibly be found with the effort of detail investigation in the border region between Suiyuan, Chahar, Shensi, and Hopei provinces.

#### PEGMATITIC AND HYDROTHERMAL VEINS OF THE NANLING RANGE

26. The Nanling Range has long been known to have the main reserve of tin and tungsten of China. Some minerals of rare metals which were worked out in association with tin and tungsten ores in the past were considered as useless gangue-minerals by native miners. With the modern development in the uses of rare metals, the discoveries of such deposits have been reported at a few scattered prospectings in Kiangsi, Hunan, and Kwangsi provinces.
27. In Tungmaoling, Kansien, Kiangsi (贛縣銅模嶺) granite-pegmatite veins intruded into Mesozoic granites contain cassiterite, tourmaline, and beryl. Those in Sihwashan of Tayu (大庾西華山) contain beryl, cassiterite, scheelite, topaz, fluorite, wolframite, lepidolite, etc. The mineralogical association of cassiterite and beryl was also found in Piaotan (票塘) of that district. In Hwanai of Sinkou district (安國縣), Tachishan of Chianan (虔南大吉山), Shaping of Yutu (雲都上坪), and Shangyou (上猶) pegmatite veins are also well developed.
28. In the same province the alluvial tin-placers occurring at Chitu, Nankon (南康赤土) and Yangmaizte, Chungyi (崇美樟眉寺) contain monazite in some amount. The wolframite-placer deposits of Yangmaizte, Chungyi and Shongping, Yutu were suspected to contain uranium minerals.
29. In Shahuken, Ruchen (汝城沙湖坑), southern Hunan, the association of cassiterite, beryl, and lepidolite was reported to occur in pegmatite veins. In the tin and tungsten mining area of Fuchuan, Hosien, and Chungshan (富川黃縣鍾山) the possibilities of rare metals deposits discoveries look very bright. An occurrence of uranium-ores was reported in Huangchianping of Chungshan (鍾山黃羌坪) where a small amount of pitchblende and secondary uranium-minerals as gummite, tobernite, uranophane, and autunite occur at the intersection of a pegmatite vein and another aplite vein.

#### POSSIBLE OCCURRENCES

30. On account of similarity in the geological setup between Shantung Peninsula and Liaotung Peninsula, it is possible that some deposits may be found in Shantung province as the continuation of the three rare-metals bearing pegmatite belts of Liaotung Peninsula. The extensive occurrence of Archaean granites with pegmatite veins in the area north of the Archaean Taishan Complex, starting from Faichen (肥城), passing through Laiyu (萊蕪), Lintay (臨沭), Changyi (昌邑), to Chafoo (招遠), and Funglai (蓬萊), the possibilities of future findings. Along the coast of Tsingtao (青島), in the same province, the beach sands were reported to contain small amounts of monazite, allanite, and zircon.

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31. In the Kungshan-region ( 貢山 ), western Yunnan, columbite, beryl, and spondumene were found in numerous pegmatite veins intruded in Mesozoic granites. The same association of beryl and columbite was also found in cassiterite veins in Kwehshe ( 箇舊 ), southern Yunnan.
32. In Yangshan ( 楊山 ) in the southern vicinity of Nanking, a barite vein about 100 meters long and five meters wide, intruded into Cretaceous volcanic rocks, was found to contain a small amount of pitchblende associated with limonite.
33. In the western part of the Tianshan Range, Sinkiang ( 新疆天山 ), the occurrence of uranium-minerals is also said to have been tested by the Soviets with electrosopes.
34. Alluvial sands in Yiho-valley, Yisien, Hopei ( 河北易縣河 ) containing traces of uranium-minerals have been found. However, the exact state of occurrence at the above localities has not yet been evaluated.

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